

RESTRICTED

INSTRUCTION BOOK
FOR
NAVY TYPE CMX-50128A
INTERPHONE AMPLIFIER

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This Instruction Book is furnished for the information of commissioned, warranted, enlisted and civilian personnel of the Navy and persons authorized by the Bureau of Ships whose duties involve design, manufacture, instruction, operation and installation of radio, radar, or underwater sound equipment. The word "Restricted" as applied to this instruction book signifies that it is to be read only by the above personnel, and that its contents should not be made known to unauthorized persons not connected with the Navy.

Manufactured for

Navy Department — Bureau of Ships

BY

THE MAGNAVOX COMPANY

FORT WAYNE, INDIANA

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CONTRACTURAL GUARANTEE

The equipment, including all parts and spare parts, except vacuum tubes, shall be guaranteed for a service period of one year with the understanding that, as a condition of this contract, all items found to be defective as to design, material, workmanship or manufacture shall be replaced without delay and at no expense to the Government, provided that such guarantee and agreement shall not obligate the contractor to make replacement of defective material unless the failure, exclusive of normal shelf life deterioration, occurs within a period of two years from the date of delivery of the equipment to and acceptance by the Government, and provided further, that if any part or parts (except vacuum tubes) fail in service or are found defective in ten per cent (10 per cent) or more, but not less than two, of the total number of equipments furnished under the contract, such part or parts, whether supplied in the equipment or as spares, shall be conclusively presumed to be of defective design, and as a condition of contract subject to one hundred per cent (100%) replacement of all similar units supplied on subject contract by suitable redesigned replacements. Failure due to poor workmanship while not necessarily indicating poor design, will be considered in the same category as failure due to poor design. Redesigned replacements which will assure proper operation of the equipment shall be supplied promptly, transportation paid, to the Naval activities using such equipment, upon receipt of proper notice and without cost to the Government. All defective parts originally furnished under contract shall be held subject to rejection and return to the contractor.

This period of two years and the service period of one year shall not include any portion of the time that the equipment fails to give satisfactory performance due to defective items and the necessity for replacement thereof, and provided further, that any replacement part shall be guaranteed to give one year of satisfactory service.

REPORT OF FAILURE

Report of failure of any part of this equipment during its service life, shall be made to the Bureau of Ships in accordance with current instructions. The report shall cover all details of the failure and give the date of installation of the equipment. Refer to latest revision of Bureau of Ships Circular Letter No. 40 for instructions concerning Reports of Failures, etc.

Contract NXsr-49686

Date of Contract 19 February, 1944

Serial No. of Equipment _____

Date of Acceptance by the Navy _____

Date of Delivery to Contract Designation _____

Date of Completion of Installation _____

Date Placed in Service _____

REPLACEMENT PARTS

When requisitioning replacement parts always furnish the following listed information:

- (A) Quantity Required.
- (B) Magnavox Part Number.
- (C) Navy Type Number (when applicable).
- (D) Item Number (obtain from Parts List).
- (E) Manufacturer of Part, and his Part Number.
- (F) Type Number of Unit from which Part is Removed.
- (G) Serial Number of Unit.

GENERAL DESCRIPTION OF EQUIPMENT

The CMX-50128A Interphone Amplifier is designed for use in vehicles and craft using the Navy Model TCS Radio Transmitting and Receiving Equipment having a two to five man crew. This unit permits two-way intercommunication between the crew, and control of the transmitting and receiving functions of the TCS Equipment by any of the crew members.

Provision is made on the amplifier input to operate the amplifier from a carbon microphone at each of the remote positions. On the output plug, J-104, pin #8 permits the output of a radio receiver or some other source of audio frequency to be amplified and distributed by the amplifier to each of the remote positions. There are two output channels, one of 125 ohms from the secondary of the output transformer to operate the speakers or headphones at the remote positions, and the other to properly match the carbon microphone input on the transmitter from the amplifier transformer secondary, through an attenuation network and potentiometer R-109. Potentiometer R-101 controls the level of the receiver input to the amplifier.

The potentiometers R-101 and R-109 have slotted shafts and are varied by means of a screw driver. It is necessary to remove the cover to make this adjustment so that once they are set, they will remain so until it is necessary to change them.

Potentiometer R-101 controls the volume of the radio receiver only. R-109 controls the volume of the carbon microphone as fed to the radio transmitter only. There is no volume control in the amplifier for the microphone as used for intercommunication. This volume is adjusted by the volume controls on the individual remote control units.

The control boxes used with this installation are two or more, Navy Type —23355 Remote Control Units, each unit being similar to Navy Type —23270 Remote Control Unit normally supplied with the Navy Model TCS Equipment. The only difference between the two boxes is that the —23355 Control Box incorporates two microphone and two headphone jacks and an additional switch has been provided to permit operation of the microphone with the interphone system without the transmitter going on the air.

In addition to the above type control box, Navy Types —23366 and —23429 Control Units may be used as remote stations as are installed on F.M. Co. 70X1011C or equivalent Junction Boxes. They provide all the features of the Type —23355 Control Box except that a speaker is not incorporated.

EQUIPMENT FURNISHED BY CONTRACTOR

Basic Interphone Unit

Weight

Magnavox No. X-700173 (Contract NXsr-49686) 17 lbs.

Replacement Parts

One set of Unit Spares is attached to each Amplifier as an integral part.

One set of Operating Spares is supplied for every four units (25%). See Page 28 for list comprising Operating Spares.

One set of Depot Spares is supplied for every ten amplifier units (10%). See Page 29 for list comprising Depot Spares.

Instruction Books

Two instruction books are shipped with each unit.

EQUIPMENT NOT FURNISHED BY CONTRACTOR BUT NECESSARY FOR INSTALLATION AND OPERATION

(1) Remote Control Units

Navy Types —23355, —23366, or —23429 for Interphone only.

(2) TCS — for Intercommunication and Radio Trans./Rec.

(3) Necessary cables, etc.

NOTE:

By connecting terminals 5 and 6 of socket J104 to the positive 12 volt supply and terminal 7 of socket J104 to the negative (grounded) 12 volt supply, the Interphone Amplifier may be operated without the TCS Equipment and controlled from two or more Navy type -23355, -23366, or -23429 Remote Control Units connected to sockets J-101, 102 and 103.

DESCRIPTION OF INTERPHONE AMPLIFIER

The CMX-50128A Interphone Amplifier, Magnavox X-700173 (Figures 1, 2, 3, 4, 5 and 6) is a single push-pull stage, using two 12A6 tubes (V-101 and V-102). The T-101 transformer primary is for operation from a carbon microphone of 75 to 200 ohms (Pin #4 on J-101, J-102, J-103 to ground). The input impedance for receiver input is 600 ohms by virtue of potentiometer R-101 (Pin #8 on J-104 to ground).

Capacitor C-101 isolates the D.C. in the microphone circuit from R-101 and any associated receiver circuits, while resistor R-102 in combination with condenser C-101 adjusts the frequency characteristics to fall within the specified limits, prevents the setting of R-101 from affecting microphone output and permits R-101 to present a constant load of 600 ohms to the radio receiver regardless of the setting of R-101.

The Output Transformer T-102 is designed to operate into a 125-ohm load (four 500-ohm Remote Control Units). Resistor R-105 and R-106 are in the cathode circuits of V-101 and V-102 respectively and are by-passed by C-102B and C-102C. By thus separately self-biasing the tubes, the amplifier will continue to operate with normal voltages on one tube, in case that one tube failed and was removed from the amplifier.

Capacitor C-102 is a 4-section electrolytic condenser. An R.F. filter C-103, C-105 and L-101 is connected in the dynamotor primary supply to prevent R.F. hash caused by the dynamotor from entering the battery leads and causing interference in the radio equipment. Filament and dynamotor primary voltage is derived from the 12-14 volt storage battery which is normally the source of power in the vehicle or craft in which this equipment is installed. The two 12.6 volt filaments are connected in parallel. High voltage D.C. is generated by the dynamotor secondary and is 250 volts at .06 amps. D.C. with a rated input of 14 volts at 2.4 amps.

The dynamotor mounted to the amplifier base may be removed by means of locking slides. Electrical connection between the dynamotor and the amplifier is made by socket J-105 in the dynamotor

base and the cushioned plug P-101 on the amplifier chassis. The 250 volt supply is filtered by filter choke L-102 and capacitor C-102D.

Microphone voltage is supplied from the storage battery through the filter consisting of resistor R-103 and capacitor C-102A. The fuse holder, F-102 marked FUSE, contains the 10-ampere fuse F-101 which fuses the battery supply to the amplifier. Two spare fuses are mounted in clips riveted to the base adjacent to the dynamotor. All connections to the amplifier are made through the wall plugs J-101, J-102, J-103 and J-104.

A receiver input of 10 volts at 1000 cycles between terminal 8 and ground (terminal 7) of socket J-104 (with input control R-101 tuned to full "on") develops 22 volts across a 125-ohm load connected to terminal 8 and ground (terminal 7) of sockets J-101, 102 or 103. Using a "dummy mike" resistor of 125 ohms an input of 0.75 volts at 1000 cycles from terminal 4 to ground (terminal 7) of socket J-101, 102 or J-103 develops 21 volts across a 125 ohm load connected to terminal 8 and ground (terminal 7) of socket J-101, 102 or 103. When the output voltage across a 125 ohm load connected to terminal 8 and ground (terminal 7) of socket J-101, 102 or 103 is 21 volts, the output to ground at terminal 4 to terminal 7 of socket J-104 is 2.0 volts with potentiometer R-109 at maximum and 0.5 volt with R-109 at minimum. This represents the equivalent microphone signal which modulates the TCS transmitter by being fed into the microphone transformer of the TCS transmitter unit.

VACUUM TUBES

Three vacuum tubes are installed in each unit; two for operation and one for a unit spare. All three are type 12A6 and are listed on the Army-Navy Preferred List of Vacuum Tubes.

MICROPHONES

The amplifier is designed for use with single button carbon microphones.

INSTALLATION OF THE CMX-50128A AMPLIFIER

MOUNTING AMPLIFIER. Specifications for the exact location of the units of the TCS Equipment together with the Interphone Amplifier are usually determined in the pilot model of each type

vehicle or craft. The mounting holes of the amplifier and overall dimensions are shown in Figure 5. In general, the amplifier should be placed as close as is possible to the TCS power supply; preferably on the right side. This will permit the most convenient layout of cables.

ADJUSTMENT. The interphone amplifier is supplied power by turning on the "receiver" switch on any of the Remote Control Units or on the panel of the receiver. After the amplifier has been installed and inter-connected with the receiver and transmitter, the following adjustments must be made in the order listed:

1. Turn on the receiver. This places the receiver and interphone amplifier in operation.
2. Turn both RF and AF gain controls of the receiver to "off."
3. Plug microphone into one of any of the Remote Control Units.
4. Plug a pair of headphones into any or each of the Remote Control Units.
5. Speak in the tone and level of voice that will be used by crew members when the radio and interphone equipment is in normal use.
6. Adjust the headphone level at each of the individual Remote Control Units to the desired level by means of volume Control (R-601) on each of the units.
7. This setting of individual volume controls should be used throughout the remainder of the adjustments.
8. With the headphones plugged into the phone jack on the receiver, tune in a signal on the receiver, and bring it up to the desired level in the headphones by means of the "AF" and "RF" Gain Controls on the receiver.
9. Now remove the headphones from the receiver, and plug them into one of the "phones" jacks of one of the Remote Control Units.

10. With a screw driver, adjust the gain of the interphone amplifier, turning potentiometer R-101 (Radio) until the level of signal in the headphones is again the desired level as was set in Operation 8 above.
11. Place the transmitter in operation by operating the "transmitter" switch on any of the Remote Units or on the panel of the transmitter. Allow the tubes sufficient time to heat.
12. With the transmitter on "Voice," and correctly in tune plug in a microphone of the type to be used with this installation in the "microphone or key" jack on the transmitter
13. With any type receiver — other than the one associated with this transmitter under installation, tune in the transmitter, and if possible, place an output meter across the headphones of the receiver.
14. Speak with a constant voice level into the microphone, noting the level received in the headphones and on the output meter if used.
15. Now remove the microphone from the transmitter and plug it into one of the "mike" jacks of one of the Remote Control Units.
16. Now speak into the microphone with the same constant voice level as used when microphone was plugged into the transmitter (in Operation 14 above). Adjust R-109 with a small screw driver, until the signal level in the headphones, and the signal level indicated on output meter (if meter is used) is the same as indicated when microphone was plugged into the transmitter.

ADDITIONAL EQUIPMENT REQUIRED

Reference should be made to the Instruction Books supplied with the additional equipment used with this amplifier.

POWER SUPPLY

The CMX-50128A Interphone Amplifier receives all of its power from a 12-14 volt battery. Do not apply over 14 volts D.C. at any time on the unit. The dynamotor is designed to operate from a battery having the negative side at ground potential.

CURRENT DRAIN OF CMX-50128A AMPLIFIER

Input Voltage	Load	Current Drain
12	Amplifier only	1.9A
14	Amplifier only	2.2A

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF MEDIUM HIGH VOLTAGES SUCH AS 250 VOLTS WHICH ARE SOMETIMES DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. UNDER CERTAIN CONDITIONS DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE "OFF" POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES, ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

OPERATION CHECK

The CMX-50128A Amplifier has no switches and usually receives its power from the same source, and through the same switch that supplies power to the receiver. The speaking of any one of the crew into any of the microphones plugged into any of the Remote Control Units, will be heard by himself and by the remainder of the crew by means of their headphones plugged into the Remote Control Units. If the conversation of the crew member speaking is desired to be transmitted by radio, the switch S-604 on the Remote Control Unit into which this crew member's microphone is plugged, must be operated to the RADIO position. If the conversation of the crew member speaking is directed to another member of the crew and not intended to be transmitted on the air, the switch S-604 should be operated to the INTER COM. position.

The output of the receiver is normally fed into the interphone amplifier and the receiver output should be heard at all times by all crew members. The maximum volume of the receiver into the interphone amplifier and consequently into each of the headphones

of the crew members, is directly controlled by the radio operator. Individual control of headphone volume to each of the Remote Control Units is provided by the adjustment of the Volume Control on each of the Remote Control Units.

The volume of the interphone amplifier when operating as an interphone system, is controlled individually at each of the Remote Control Units. This was adjusted as described in Paragraphs 1 to 6 inclusive on Page 11.

MAINTENANCE and TROUBLES

Routine check of this system after original installation or at the time of engine check should be as follows:

- (a) Check receptacles for tightness.
- (b) Check fuse.
- (c) Check vacuum tubes, V-101 and V-102 in standard tube checker.
- (d) Lightly dress or clean commutators of dynamotor with crocus cloth or No. 000 sandpaper.

When determining partial failures, the following procedure is suggested:

Q. Dynamotor will not start when power switch is turned on.

A. (1) Make certain that there is 12-14 D. C. power at the termination of the power cable.

- (2) Defective fuse.
- (3) Defective dynamotor.
- (4) Defective switch controlling power from battery.
- (5) Defective power cable or associate receptacles.
- (6) Loose connections.

Q. Low or distorted output.

A. (1) Defective tubes.

- (2) Defective dynamotor.
- (3) Defective microphone.
- (4) Defective headphones.
- (5) Defective part.
- (6) Loose or poor connection.

Q. Noisy operation.

A. (1) Lack of proper bonding.

(2) Lack of ground on shielded cable.

(3) Intermittent ground.

(4) Commutators carbonized.

(5) Open condenser and dynamotor filter or in by-pass circuit of Interphone Amplifier unit.

(6) Defective tubes.

(7) Defective microphones.

(8) Defective headphones.

(9) Loose connection.

Q. Dynamotor runs but inter-communication system does not operate.

A. (1) Reverse battery polarity.

(2) Defective tubes.

(3) Defective parts.

(4) Loose or poor connections.

IN ORDER TO OBTAIN FULL TUBE LIFE AND PROPER OPERATION, DO NOT USE TUBES OF OTHER TYPES THAN THOSE HEREIN SPECIFIED. THE DESIGN OF THIS INTERPHONE EQUIPMENT IS SUCH THAT NORMAL VOLTAGE CHARACTERISTICS WILL BE SUPPLIED TO THE TUBES USED WITHOUT MANUAL READJUSTMENT OVER THE 12 TO 14 VOLT OPERATIONAL RANGE.

ALL TUBES FURNISHED AS INITIAL SUPPLY OR SPARES SHALL BE CONSUMED PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

DYNAMOTOR

Detail Description, Operation and Maintenance

D. C. INPUT
14 VOLTS 2.4 AMPS.

D. C. OUTPUT
250 VOLTS .060 AMPS.

The dynamotor unit is a round bodied, two-pole, d. c. to d. c. rotating machine. It is totally enclosed and equipped with grease lubricated ball bearings. Skeleton-type bearing brackets and cart-ridge-type radial brush holders afford easy commutator and brush access.

A common field and armature core is used. The armature carries two windings insulated from the core and from each other. Each of these windings is connected to a commutator. The ratio between input and output voltage is fixed, being determined by the windings of the armature. It is therefore not possible to regulate the output voltage except by adjusting the input voltage.

The power source should be a 12-14 volt storage battery of ample capacity to accommodate the requirements of all of the other radio equipment in addition to this dynamotor drain. A charging generator capable of keeping the battery fully charged at all times, should be connected through a reverse current cut-out to the battery.

If the Interphone system is operating satisfactorily with the dynamotor noise at a suitably low level, it should require no attention except for the cleaning away of accumulated dust and dirt periodically.

For access to the commutators, brushes and bearings, it is necessary to remove the end covers. These end covers are held in place by fillister-head screws that have their heads cross-drilled for safety wiring.

LUBRICATION

Grease-sealed ball bearings are used. They are lubricated for approximately 1000 hours of operation or six months of ordinary service before the dynamotor leaves the factory. An occasional inspection will reveal when it is necessary to re-lubricate.

To inspect the bearings or to add grease, remove the end covers and the bearing plates from the dynamotor. A sufficient amount of clean grease should be added so that the bearings are covered. Too much grease should not be packed around the bearings as it

will work out through the bearing seals when the dynamotor is running and cause excessive heating due to the churning of the grease. Two types of greases recommended are "Lubriko M-6" made by Master Lubricants Co., Philadelphia, Pa., and "F-927" made by New York and New Jersey Lubricant Co. of New York City.

If grease of the recommended grades is not obtainable, a good grade of light ball bearing mineral grease should be used. It should have the approximate consistency of vaseline, however vaseline should not be used except in emergencies. The important considerations in the selection of grease are that it does not have affinity for moisture and must not contain any solidifying matter such as chalk, graphite or similar substances that may clog the bearings or set up a lapping action inducing wear and premature failure.

It is advisable to wash the ball bearings and clean out the old grease once a year. For such cleaning, the armature should be removed from the dynamotor but it is not necessary to remove the bearings from the shaft. The bearings and bearing housings should be washed with clean naphtha or carbon tetrachloride. The method for cleaning the housings is obvious. The bearings are washed by dipping them into a clean container of naphtha or carbon tetrachloride, using a small stiff brush to remove the old grease. The cleaning fluid should not come in contact with the armature windings. Dry the bearings thoroughly and check for smooth and free operation before replacing the armature in the dynamotor. Reassemble the machine and lubricate.

BRUSHES

Periodic inspection of the brushes and brush holders is essential. The brushes are wearing parts and should be given a visual inspection approximately every 100 hours of operation. The grade of brush material used represents a compromise between long brush wear and long commutator wear. Carbon dust formations around the brush holders is an unavoidable result of the brush wear. This carbon dust tends to accumulate on one side more than the other due to the rotation of the armature. While this dust is not serious so far as the negative brushes are concerned because they are at ground potential, it is recommended that these be brushed off at the same time that the positive brushes are cleaned. This carbon accumulation may interfere with the free movement of the brushes in their cartridges and it is therefore recommended that the carbon dust be blown out every time that the equipment is examined or

serviced. Wiping with a soft cloth saturated with carbon tetrachloride is also suggested.

The brushes should not be removed from their holders unless it is absolutely necessary to do so for replacement or major cleaning operations. If noise is present in the Interphone, other possible sources should be suspected and investigated before tampering with the dynamotor brushes. If, however, the brushes are removed and found to be in serviceable condition, they should be replaced in the holder in exactly the same position that they originally occupied.

To facilitate replacement in servicing, each brush is stamped + or — and the bearing brackets are marked + and — adjacent to the respective brush holders. The brushes must always be inserted in their respective holders with the polarity marks upward. Following this method consistently insures correct replacement at all times.

In normal service the low voltage brushes have a life of 400 to 500 operating hours. New brushes have an effective length of $\frac{3}{8}$ inch, and should be replaced after 400 hours of service or when they have worn down to approximately one-quarter inch. The high voltage brushes wear at a much slower rate and have a conservative life of 1200 to 1500 operating hours. These brushes are one-half inch long when new and should be replaced when they have worn down to approximately $\frac{1}{4}$ inch. Whenever new brushes are installed, the commutators should be sanded. (See detailed instructions in "COMMUTATOR" section that follows.)

To replace the brushes, first unscrew the brush screw plugs. The brush, shunt cable, spring, and end plug is an assembly and will come out as one piece. Replacement brushes are supplied assembled in the same manner and have also a formed radius to fit the commutators, eliminating the "sanding-in" process. Before inserting the new brushes in their respective holders, examine the shunt cable and, if necessary, shape the cable in such a manner that it is parallel to the direction of brush travel so that it will not work out between the turns of the spring and interfere with the spring action. Also, check to make sure that the brush fits freely in the holder without bind. If this condition does not exist, examine the brush holder cartridges for obstructions and if necessary, sandpaper the edges of the brushes for free fits. Replace the screw plugs after the brushes are properly in place.

After new brushes are installed, it is advisable to run them in for six to eight hours at normal load. This is the only way to make the contact surfaces conform exactly to the commutators and

to obtain the polished brush surface necessary for good commutation. Proper brush seating is very essential for satisfactory operation. Noisy and inefficient operation may be experienced until the brushes are properly worn in.

COMMUTATORS

The commutator copper is of the hardest grade commercially available. In normal operation, the copper becomes a chocolate brown color with a darker film on the section which is in contact with the brushes. This film is not a cause of noise but is rather a desirable condition and indicates good commutation. The commutators should not be sanded to remove this film.

Grease and oil must be kept off the commutators and brushes at all times. If any lubricant is present, remove it by wiping with a cloth saturated with carbon-tetrachloride.

In time, minute grooves will appear on the commutators from the action of the brushes. This is a normal condition of wear although if it gets serious, the commutators may be sanded smooth with Grade 000 or finer sandpaper while the machine is running. Canvas or crocus cloth should be used for polishing or finishing. **DO NOT USE EMERY CLOTH ON COMMUTATORS AS THE ABRASIVE IS METALLIC AND MAY CAUSE SHORT CIRCUITS IN THE ARMATURE BY BECOMING IMBEDDED IN THE SLOTS BETWEEN THE BARS.**

If the commutators become seriously worn or scored, as is quite possible after prolonged operation, it will be necessary to reface them. This requires removing the armature from the dynamotor and "turning" it in a lathe. For finish turning of the commutators, the armature must be turned on centers at a speed of approximately 500 RPM and a tool bit sharply ground for copper turning must be used. A .010" to .012" cut will usually be sufficient to clean up most commutator roughness. For this depth of cut, it is not necessary to undercut the commutator mica, but if the copper is turned down so far that the mica is also cut, it becomes necessary to file away the mica between the copper bars with a triangular or lozenge-shaped file to a cut of about .015" - 0.25" so that the brushes will not come in contact with the mica. The commutators should be polished as indicated in the above paragraphs after finish turning. The mica slots should be brushed clean of all mica, copper and sand particles before replacing the armature in the dynamotor.

BEARINGS

If the ball bearings become noisy or appear to be "rough" and the condition is not remedied by lubrication, they should be replaced with new bearings. Ball bearings for dynamotor service are specially selected for a minimum of radial and groove clearance and perfect concentricity and they should be so specified in ordering replacements. To replace the bearings, the armature must be removed from the dynamotor.

A bearing puller should be used to remove the bearings from the shaft as any other method is very likely to result in damage to the shaft or commutator. However, in an emergency, two screw drivers inserted between the grease slinger, which is adjacent to the ball bearing, and the iron core of the commutator, can be used as wedges to pry the bearings off the shaft if care is exercised.

If the grease slinger becomes bent in this operation, it can be easily straightened, and should be replaced on the shaft before putting on the new bearings.

New bearings should not be removed from their cartons until they are to be installed as they must be kept free from dust or other foreign particles which might interfere with their perfect operation. Prior to installing new bearings, they should be dipped in clean naphtha or carbon tetrachloride and using a small stiff brush, all of the grease with which they were packed should be washed away. With the bearings clean and free from grease, determine that they run smoothly and freely before placing them on the shaft. Bearings should be placed on the shaft with the shielded side toward the commutator. A light rap with the palm of the hand will drive it up to the bearing shoulder. The armature is then ready to be replaced in the dynamotor.

FIELD COILS

If for any reason, it becomes necessary to replace the field coils, the armature must first be removed. The screws holding the field poles are accessible from the outside of the dynamotor. When the poles have been removed, the field coils can readily be slipped off and a new set slipped on. Replacement field coils are supplied connected in pairs and formed to fit the curvature of the pole tips and the frame.

"Grounds" in the low voltage winding of the armature can be located by impressing two volts on the brush terminals with the

field coils and connecting leads disconnected. Use the $2\frac{1}{2}$ volt scale of a set analyzer, connecting one test prod to the frame and the other prod successively to each commutator bar. The deflection will be least when the bar to which the grounded coil is connected, is touched. The same procedure should be followed for the high voltage windings of the armature except that a 12-volt battery and the 25-volt scale of the meter should be used. This method of "ground" location is practical for only direct "grounds." High resistance "grounds" or punctured insulation can be located only by the use of equipment generating potentials at least as high as the no-load output voltage of the dynamotor.

"Dead" short circuits may often be located at the commutator bars, or in leads connecting to them and are often possible to correct. The cause may be a small copper chip between adjacent bars. Internal or partial "shorts" are beyond the probabilities of field repair and will necessitate armature replacement. Open circuits, if at the commutation bars, can be corrected by the use of a small hot soldering iron. If the "open" is inside the coil and not accessible, the two bars between which the "open" is located, can be joined together by a small jumper. The output voltage will drop slightly, but satisfactory operation will be possible for emergency use.

"Grounds" in the windings are usually caused by insulation breakdown within the armature. There is, however, a possibility of the cause being a stray chip between the commutator bars and the commutator core. Internal "grounds" cannot be corrected without rewinding the armature and it is therefore necessary that the complete armature replacement is made.

DYNAMOTOR TROUBLE CHART

The following tables have been compiled as a guide in locating and correcting troubles. The numbered paragraphs indicate the nature of the troubles and the lettered sections immediately following are possible causes.

1. Dynamotor does not start and apparently draws no current.
 - (a) Battery cable not connected.
 - (b) Open fuse.
 - (c) Dynamotor plug not inserted.
 - (d) Open circuit or poor contact in power plugs.
 - (e) Open circuit or poor contact in interconnecting plugs.
 - (f) Open circuit in amplifier chassis wiring.
 - (g) Open circuit in R. F. choke coil.
 - (h) Power switch in Remote Control Unit not making contact.
 - (i) Low voltage brushes not making contact on commutator.
2. Dynamotor draws heavy current but does not run, or turns over slowly.
 - (a) "Open," "grounded" or "shorted" field coil.
 - (b) Short circuit in low voltage armature winding.
 - (c) Punctured or grounded L.V. capacitor.
 - (d) Partial or complete short in B+.
 - (e) Armature binding due to defective bearings or assembly.
3. Dynamotor runs but gives low output voltage.
 - (a) "Short" in high voltage armature winding.
 - (b) Punctured or grounded H.V. capacitor.
 - (c) Grounded filter choke coil.
 - (d) "Short" in amplifier chassis wiring.
 - (e) Grounded resistor in amplifier chassis.
4. Dynamotor runs but gives no output voltage.
 - (a) H.V. brushes not making contact with commutators (may be binding in brush holders).
 - (b) "Open" connecting lead.
 - (c) "Open" filter choke coil.
 - (d) "Open" resistor in amplifier chassis.
 - (e) "Open" amplifier chassis wiring.
5. Noise in Interphone.
 - (a) Poor connection in plugs.
 - (b) Loose connection in wiring.
 - (c) Improperly fitted brushes.
 - (d) Weak brush springs.
 - (e) "Open" armature coil.
 - (f) Loose connection in H. V. capacitors.
 - (g) Defective filter choke.

12A6

BEAM POWER AMPLIFIER

Heater†	Coated Unipotential Cathode	
Voltage	12.6	a-c or d-c volts
Current	0.15	amp.

Direct Interelectrode Capacitances (Approx.):*

Grid to Plate	0.3	uuf
Input	9.0	uuf
Output	9.0	uuf

Maximum Overall Length 3¼"

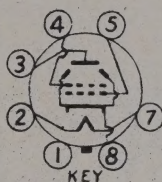
Maximum Seated Height 211/16"

Maximum Diameter 15/16"

Bulb

Base

- Pin 1 — Shell
- Pin 2 — Heater
- Pin 3 — Plate
- Pin 4 — Screen



- Metal Shell, MT-8
- Small Wafer Octal 7-Pin
- Pin 5 — Grid
- Pin 7 — Heater
- Pin 8 — Cathode

Mounting Position Any

Maximum Ratings are Design-Center Values

AMPLIFIER

Plate Voltage	250 max.	volts
Screen Voltage	250 max.	volts
Plate Dissipation	7.5 max.	watts
Screen Dissipation	1.5 max.	watts

Operating Conditions and Characteristics—Class A₁ Amplifier:

Plate	250	volts
Screen	250	volts
Grid§	-12.5	volts
Peak A-F Grid Voltage	12.5	volts
Zero-Signal Plate Current	30	ma.
Max.-Signal Plate Current	32	ma.
Zero-Signal Screen Current	3.5 approx.	ma.
Max.-Signal Screen Current	5.5 approx.	ma.
Plate Resistance	70,000 approx.	ohms
Transconductance	3,000	umhos
Load Resistance	7,500	ohms
Total Harmonic Distortion	7	%
Max.-Signal Power Output	3.4	watts

†In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.

*With shell connected to cathode.

§The d-c resistance in the grid circuit should not exceed 0.1 megohm when fixed bias is used, or 0.5 megohm when cathode bias is used.

TABLE I
PARTS LIST BY SYMBOL DESIGNATIONS
FOR
Navy Type CMX-50128A Interphone Amplifier

Symbol Design.	Function	Description	Navy Type Number	Mfr.	Mfr. Design.	Magnavox Drawing and Part No.
CAPACITORS						
C-101	Radio input coupling capacitor	Paper, oil-filled .5 mfd. 400 V. DCW	For replacement, use Navy type —481002	4	A-7645	A250077G1
C-102 A	Microphone filter	Electrolytic capacitor 40 mfd. 50 V. DCW		1		C270020G1
C-102 B	V-101 cathode by-pass	Electrolytic capacitor 40 mfd. 50 V. DCW				
C-102 C	V-102 cathode by-pass	Electrolytic capacitor 40 mfd. 50 V. DCW				
C-102 D	High voltage filter	Electrolytic capacitor 100 mfd. 300 V. DCW				
C-103	R.F. filter for dynamotor primary	Same as C-101				
C-104	Output coupling	Paper, oil-filled 2 mfd. 600 V. DCW		4	A-7033	B250096G1
C-105	R.F. filter for dynamotor primary	Electrolytic capacitor 40 mfd. 40 V. DCW		1		B270020G3

DYNAMOTOR					
D-101		Dynamotor unit complete with base	—21400	1	X530006G2
D-102		Spare brush set		12	X530011G1
MISCELLANEOUS ELECTRICAL PARTS					
FUSES					
E-101	Receptacle for fuse	Fuse holder for F-101		11	A180244
F-101	Used in D.C. input line	10-ampere, 25-volt 1/4" dia. 1 1/4" long		11	A180157G1
RECEPTACLES					
J-101	Input receptacle	Wall plug 9-contact		10	A180195G5
J-102	Input receptacle	Same as J-101			
J-103	Input receptacle	Same as J-101			
J-104	Output receptacle	Same as J-101			
J-105	Dynamotor power socket	Socket 3-contact			X180208
INDUCTANCES					
L-101	Radio frequency choke	39.5 microhenries; D.C. resistance less than .08 ohm		1	XC360224G1
L-102	High voltage filter choke	Minimum inductance, 4.1 henries; D.C. resistance 130 ohms		2	B350009
PLUGS					
P-101	Dynamotor power plug	Plug, 3-contact		1	A180203
P-101 A	Cushion for P-101 socket	Rubber grommet		1	A101916

TABLE I
PARTS LIST BY SYMBOL DESIGNATIONS — Continued
FOR
Navy Type CMX-50128A Interphone Amplifier

Symbol Desig.	Function	Description	Navy Type Number	Mfr.	Mfr. Desig.	Magnavox Drawing and Part No.
RESISTORS						
R-101	Radio input potentiometer	Potentiometer, 600 ohms $\pm 5\%$ 4 watt—wire wound, linear		3	252	B220047G1
R-102	Radio input coupling	6800 ohms $\pm 10\%$ $\frac{1}{2}$ watt, composition pigtail	—63360	5	C-1	B230063G72
R-103	Microphone filter	150 ohms $\pm 10\%$ 1 watt, composition pigtail	—63288	5	C-1	B230062G52
R-104	Loading for T-101 secondary winding	330,000 ohms $\pm 10\%$ $\frac{1}{2}$ watt composition pigtail	—63360	6	BT- $\frac{1}{2}$	B230063G92
R-105	V-101 cathode bias resistor	390 ohm $\pm 10\%$ 1 watt composition pigtail	—63288	6	BT-1	B230062G57
R-106	V-102 cathode bias resistor	Same as R-105				
R-107	Radio output network resistor	2200 ohms $\pm 10\%$ $\frac{1}{2}$ watt composition pigtail	—63360	6	BT- $\frac{1}{2}$	B230063G50
R-108	Radio output network resistor	100 ohms $\pm 10\%$ $\frac{1}{2}$ watt composition pigtail		7	710	B230063G50
R-109	Radio output network resistor	Same as R-101				

TRANSFORMERS					
T-101	Input transformer	Primary D.C. resistance 26 ohms; secondary D.C. resistance 2770 ohms; turns ratio: 26:1	2	2D187	B320010
T-102	Output transformer	Primary D.C. resistance 422 ohms secondary D.C. resistance 6.6 ohms; turns ratio: 10:1	2	3A574	B330012
VACUUM TUBES					
V-101	Amplifier tube	Type 12A6 vacuum tube	8	12A6	
V-102	Amplifier tube	Same as V-101			
V-103	Spare tube	Same as V-101			
SOCKETS					
X-101	V-101 socket	Vacuum tube socket, octal	49351	9653	A180194G3
X-102	V-102 socket	Same as X-101			
X-103	V-103 socket	Same as X-101			

TABLE IIA
OPERATING SPARE PARTS FURNISHED WITH
EACH FOUR BASIC UNITS
Navy Type CMX-50128A Interphone Amplifier

Desig.	Quan.	Description	Mfr.	Mfr. Desig.	Magnavox Drawing and Part No.
C-101 } C-103 }	1	Capacitor, 0.5 mfd. 400 volt	4	A7033	A250077G1
C-102 A, B, C & D	1	Capacitor, 4 section electrolytic	1		C270021G2
	2	Mounting plate	1		A280008
C-104	1	Capacitor, 2 mfd. 600 volt	4	A7645	B250096G1
C-105	1	Capacitor, 40 mfd. 40 volt electrolytic	1		B270020G3
D-101	1	Dynamotor assembly	1		X530006G5
D-102	5	Dynamotor brush sets	12		X530011G4
E-101	1	Fuse holder	11	HKM	A180244
F-101	10	Fuse, 10 amp. 25 volt	11	3AG-10	A180157G1
J-101 } J-102 } J-103 } J-104 }	2	Receptacles, input and output	10	GK-9-32S	A180196G5
J-105	1	Socket, dynamotor connection	1		XA180208
L-101	1	Radio frequency choke	1		XC360224G1
L-102	1	High-voltage filter choke	2	1B143	B350009
P-101	1	Plug, dynamotor connection	1		XA180203
R-101 } R-109 }	1	Potentiometer, 600 ohm	3	252	B220047G1
R-102	1	Resistor, 6800 ohm, 1/2 watt	5	C1	B230063G72
R-103	1	Resistor, 150 ohm, 1 watt	5	C1	B230062G52
R-104	1	Resistor, 0.33 megohm, 1/2 watt	6	BT-1/2	B230063G92
R-105	1	Resistor, 390 ohm, 1 watt	6	BT-1	B230062G57
R-107	1	Resistor, 2200 ohm, 1/2 watt	6	BT-1/2	B230063G66
R-108	1	Resistor, 100 ohm, 1/2 watt	7	710	B230063G50
T-101	1	Input transformer	2	2D187	B320010
T-102	1	Output transformer	2	3A57	B330012
V-101 } V-102 } V-103 }	4	Vacuum tubes, type 12A6	8	12A6	

TABLE IIB
DEPOT SPARE PARTS FURNISHED WITH
EACH TEN UNITS
Navy Type CMX-50128A Interphone Amplifier

Desig.	Quan.	Description	Mfr.	Mfr. Desig.	Magnavox Drawing and Part No.
C-101 } C-103 }	5	Capacitor, 0.5 mfd. 400 volt	4	A7033	A250077G1
C-102A, B, C & D	3	Capacitor, 4 section electrolytic	1		C270021G2
	6	Mounting plate	1		A280008
C-104	3	Capacitor, 2 mfd. 600 volt	4	A7645	B250096G1
C-105	3	Capacitor, 40 mfd. 40 volt electrolytic	1		B270020G3
D-101	3	Dynamotor assembly	1		X530006G5
D-102	20	Dynamotor brush sets	12		X530011G4
E-101	1	Fuse holder	11	HKM	A180244
F-101	50	Fuse, 10 amp. 25 volt	11	3AG-10	A180157G1
H-101	10	Hex nuts, $\frac{3}{8}$ -32			A105120G18
H-102	10	Washers, shakeproof, $\frac{3}{8}$ "			A105088G11
J-101 } J-102 } J-103 } J-104 }	8	Receptacles, input and output	10	GK-9-32S	A180196G5
J-105	2	Socket, dynamotor connection	1		XA180208
L-101	1	Radio frequency choke	1		XC360224G1
L-102	3	High-voltage filter choke	2	1B143	B350009
P-101	2	Plug, dynamotor connection	1		XA180203
R-101 } R-109 }	10	Potentiometer, 600 ohm	3	252	B220047G1
R-102	3	Resistor, 6800 ohm, $\frac{1}{2}$ watt	5	C1	B230063G72
R-103	3	Resistor, 150 ohm, 1 watt	5	C1	B230062G52
R-104	3	Resistor, 0.33 megohm, $\frac{1}{2}$ watt	6	BT- $\frac{1}{2}$	B230063G92
R-105	5	Resistor, 390 ohm, 1 watt	6	BT-1	B230062G57
R-107	3	Resistor, 2200 ohm, $\frac{1}{2}$ watt	6	BT- $\frac{1}{2}$	B230063G66
R-108	3	Resistor, 100 ohm, $\frac{1}{2}$ watt	7	710	B230063G50
T-101	3	Input transformer	2	2D187	B320010
T-102	3	Output transformer	2	3A57	B330012
X-101 } X-102 } X-103 }	2	Tube socket	9	9653	A180194G3

TABLE III
LIST OF MANUFACTURERS
For CMX-50128A Interphone Amplifier

Code	Mfr. Prefix	Name	Address
1	CMX	The Magnavox Company	Fort Wayne, Indiana
2	CTG	General Transformer Co.	Chicago, Illinois
3	CTC	Chicago Telephone Supply Co.	Elkhart, Indiana
4	CBV	John E. Fast Company	Chicago, Illinois
5	CCC	Continental Carbon Company	New York, N. Y.
6	CIR	International Resistance Co.	Philadelphia, Pa.
7	CBN	Central Radio Laboratory	Milwaukee, Wis.
8	CRC	RCA Mfg. Co., Radiotron Division	Harrison, N. J.
9	CMG	Cinch Mfg. Company	Chicago, Illinois
10	CED	Cannon Electric Dev. Co.	Los Angeles, Calif.
11	CFA	Bussmann Mfg. Co.	St. Louis, Mo.
12	CG	General Electric Co.	Schenectady, N. Y.

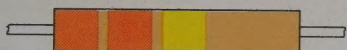
TABLE IV
RESISTOR CHART



6800 OHMS
(R-102)



150 OHMS
(R-103)



330,000 OHMS
(R-104)



390 OHMS
(R-105, R-106)



2200 OHMS
(R-107)



100 OHMS
(R-108)

**NOTE: FOURTH BAND DENOTES TOLERANCE. GOLD
BAND IS 5%; SILVER BAND 10%; NO BAND 20%.**

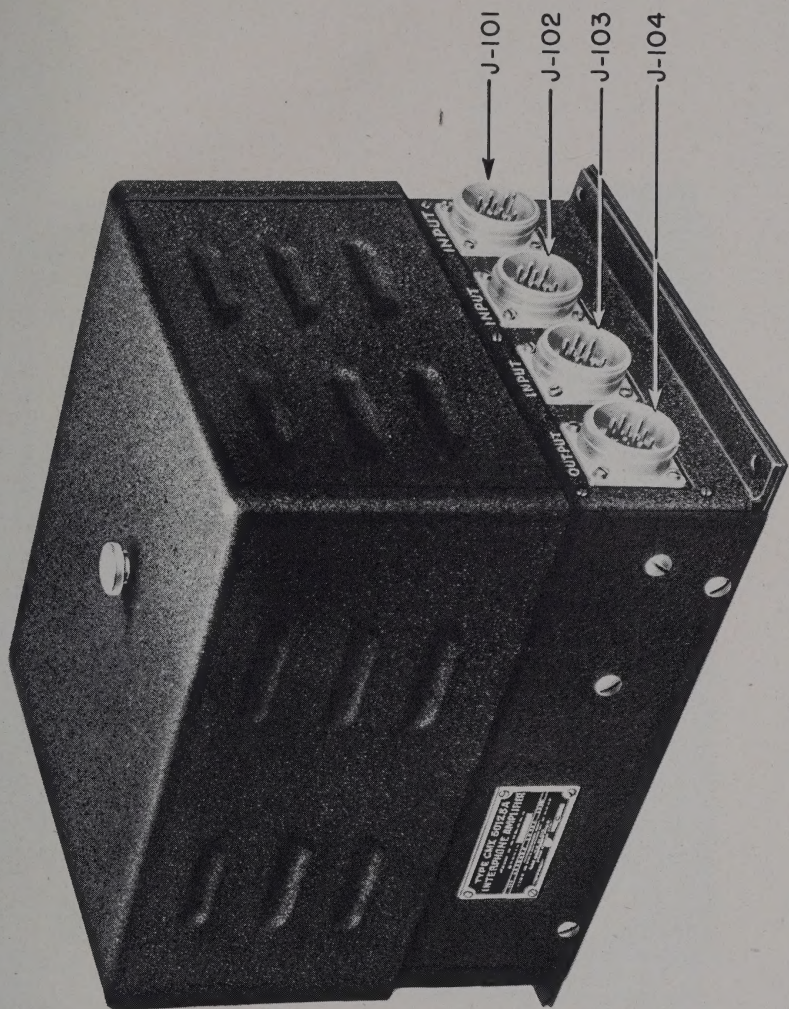


Figure 1 — Front View, Interphone Amplifier, with Cover

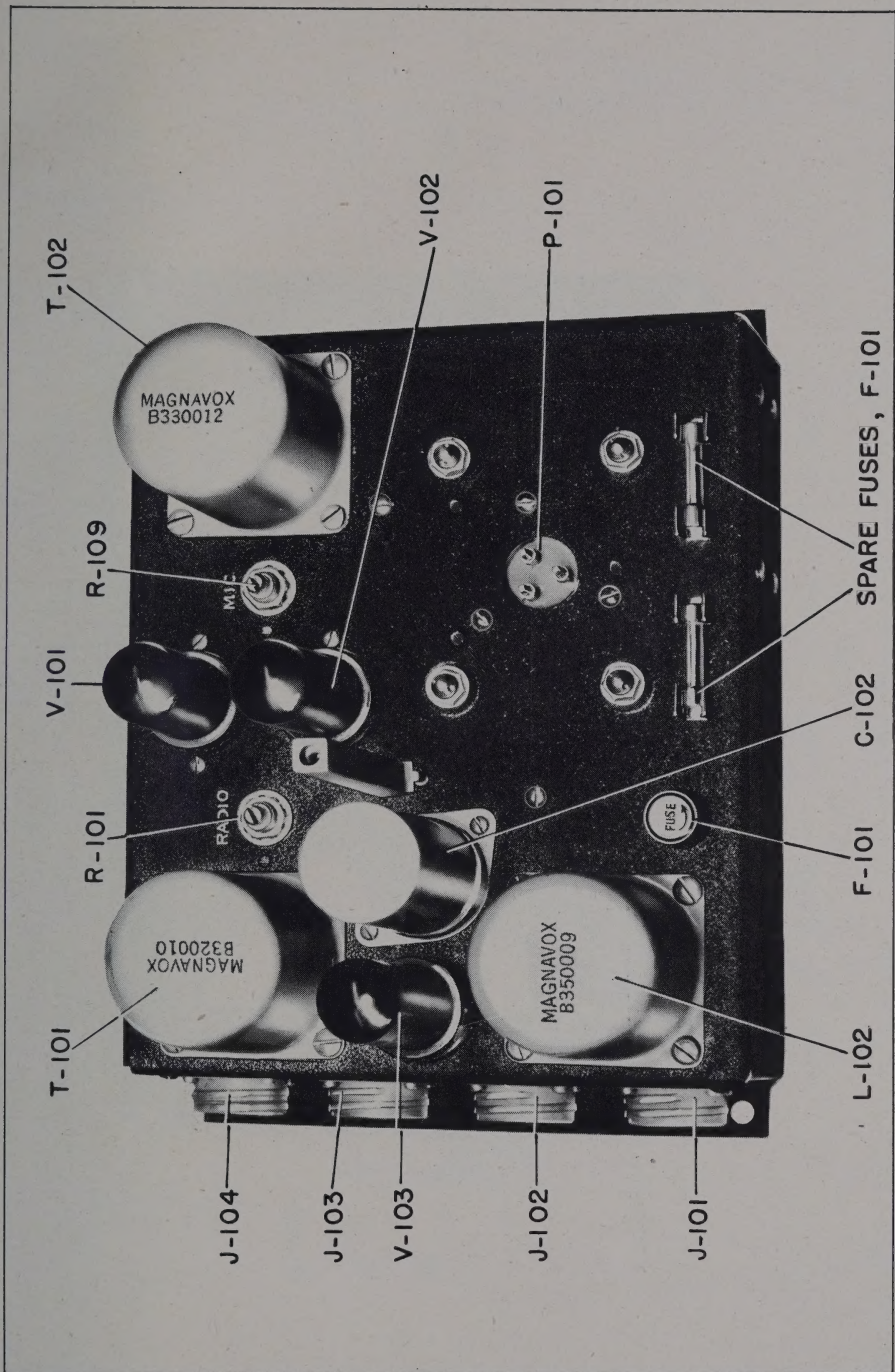


Figure 2 — Top View, Interphone Amplifier, Cover Removed

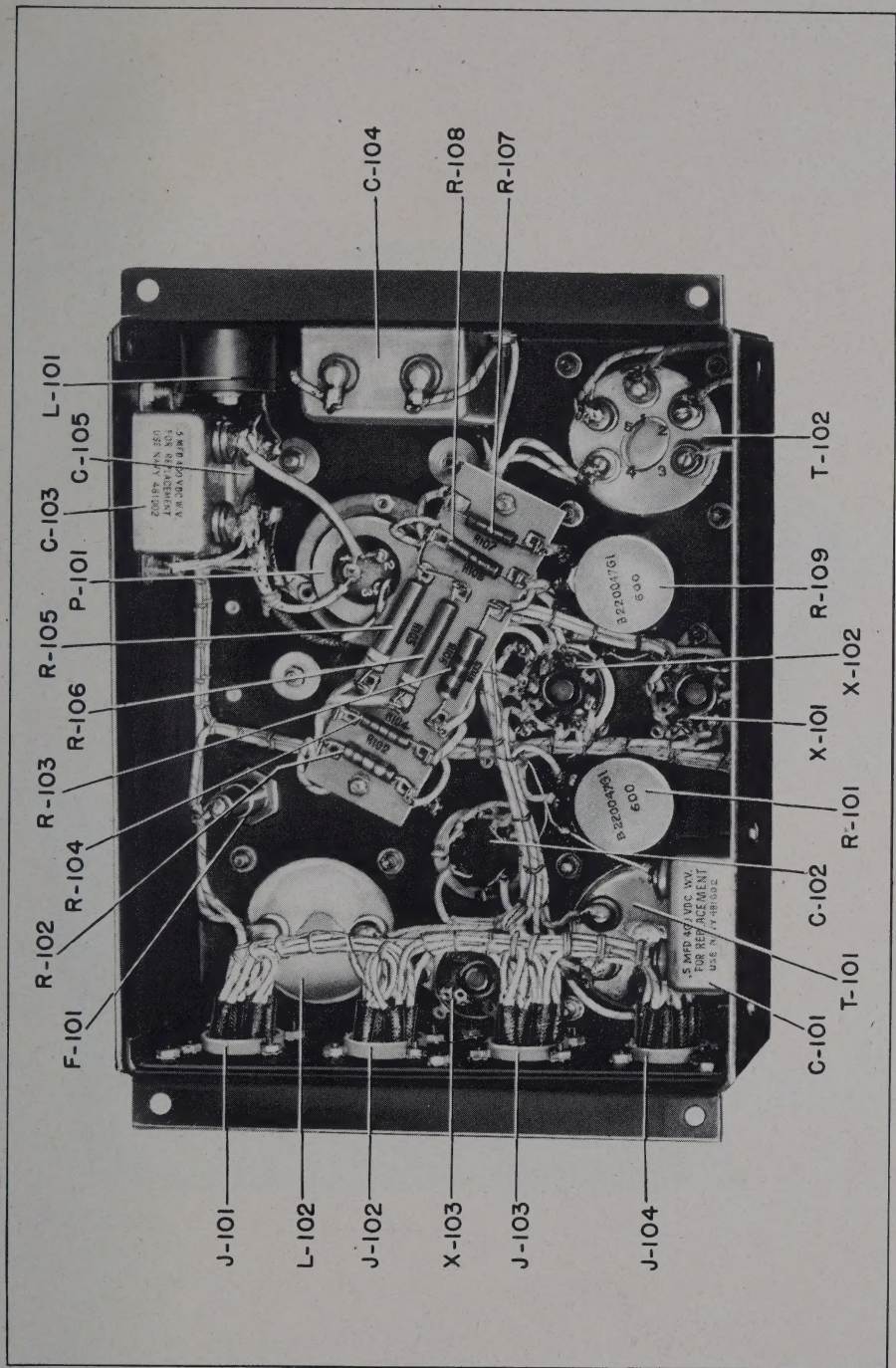


Figure 3 — Bottom View, Interphone Amplifier, Base Plate Removed

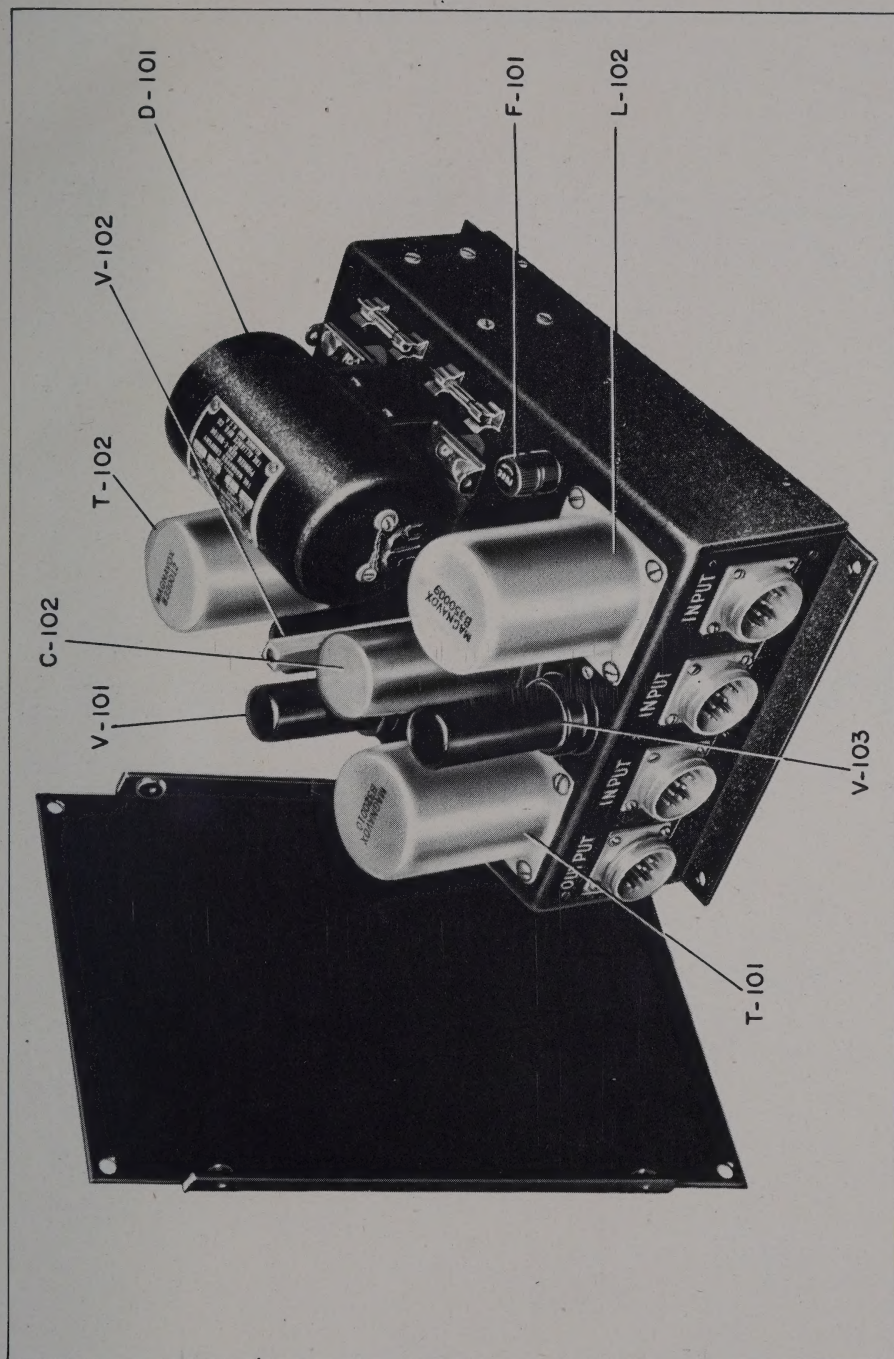


Figure 4 — Front View, Interphone Amplifier, Cover and Base Plate Removed

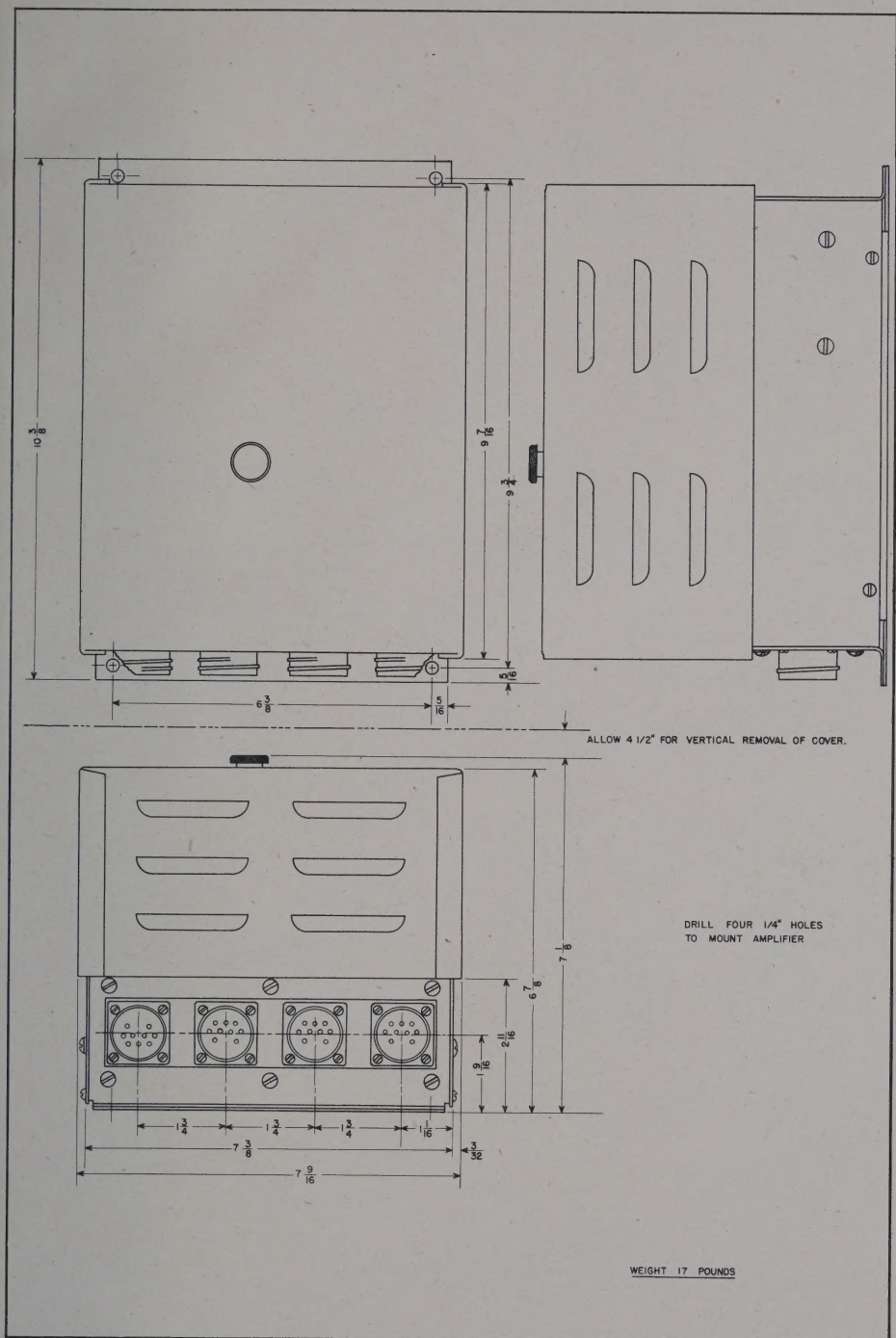


Figure 5 — Outline of Interphone Amplifier

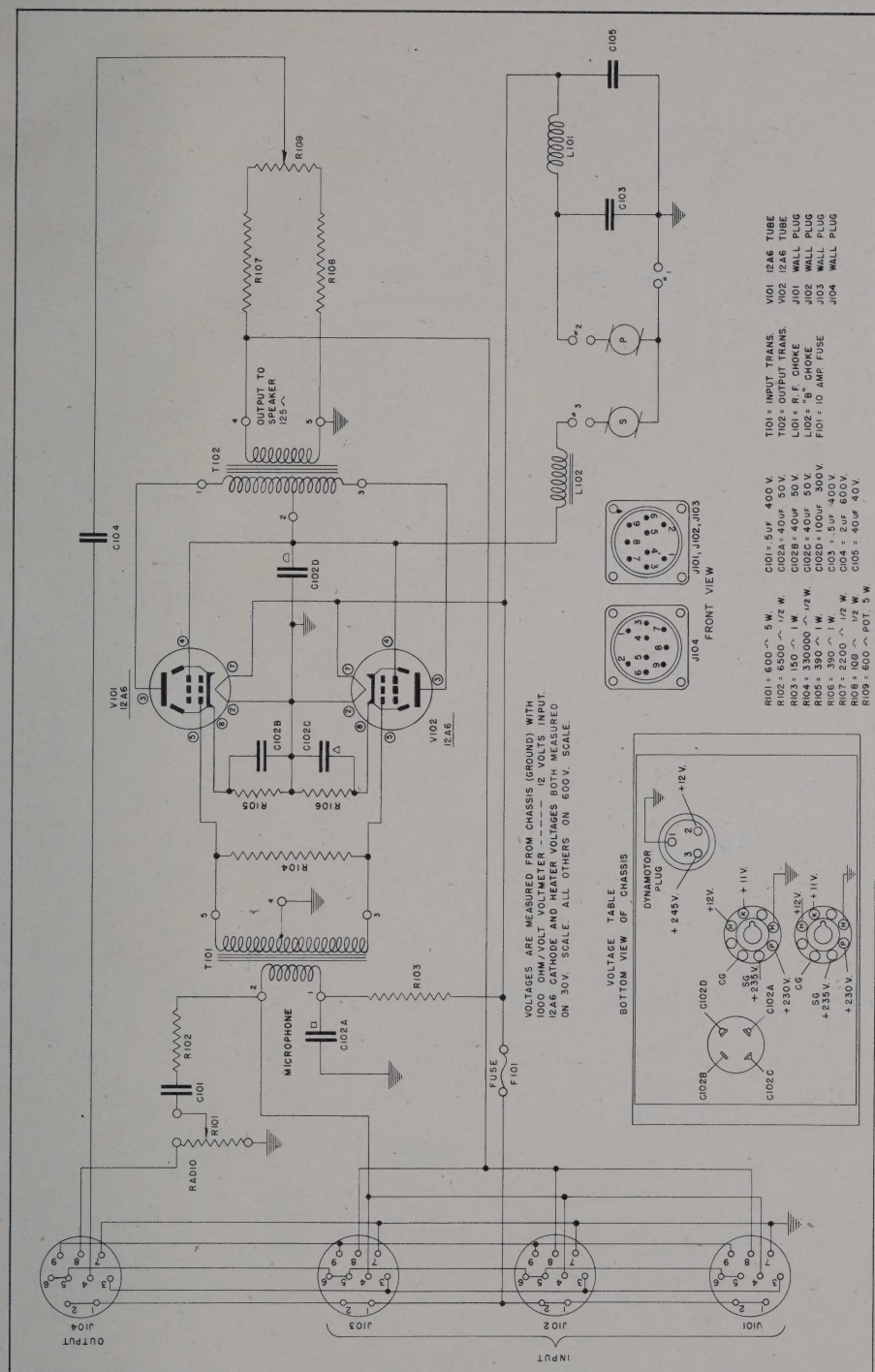


Figure 6 — Schematic Diagram of Interphone Amplifier

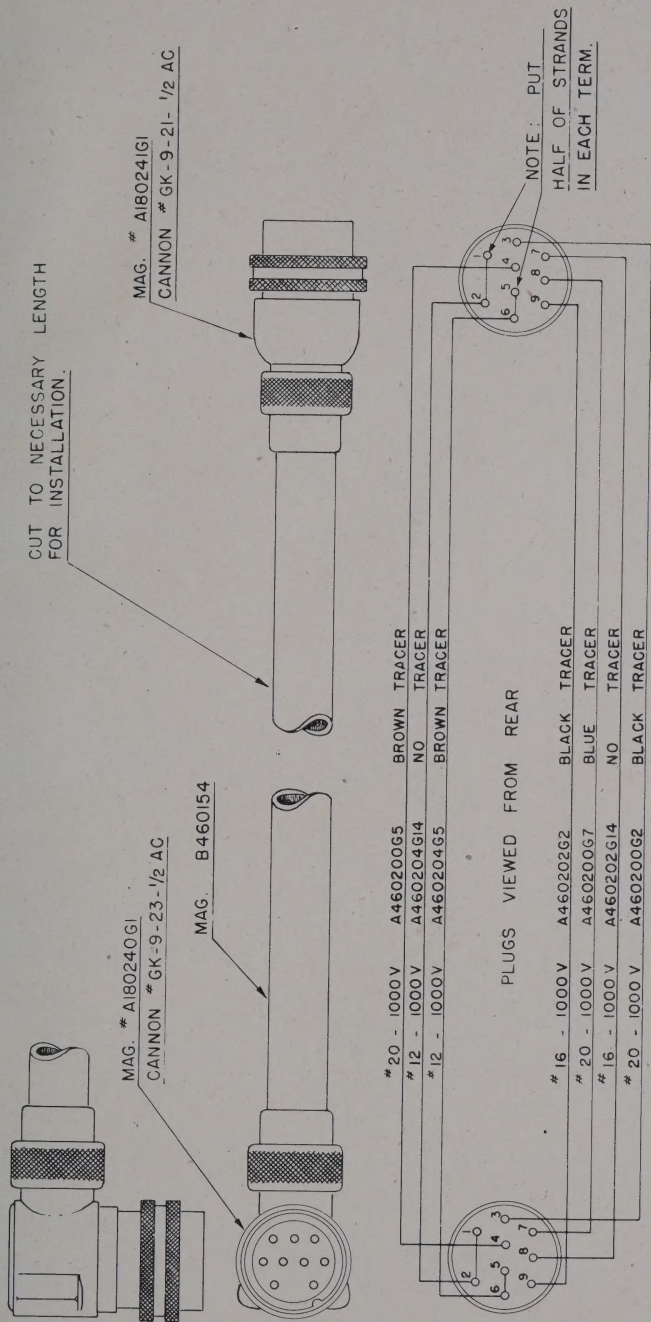


Figure 7 — Schematic and Assembly of Amplifier to Control Box Cable Assembly

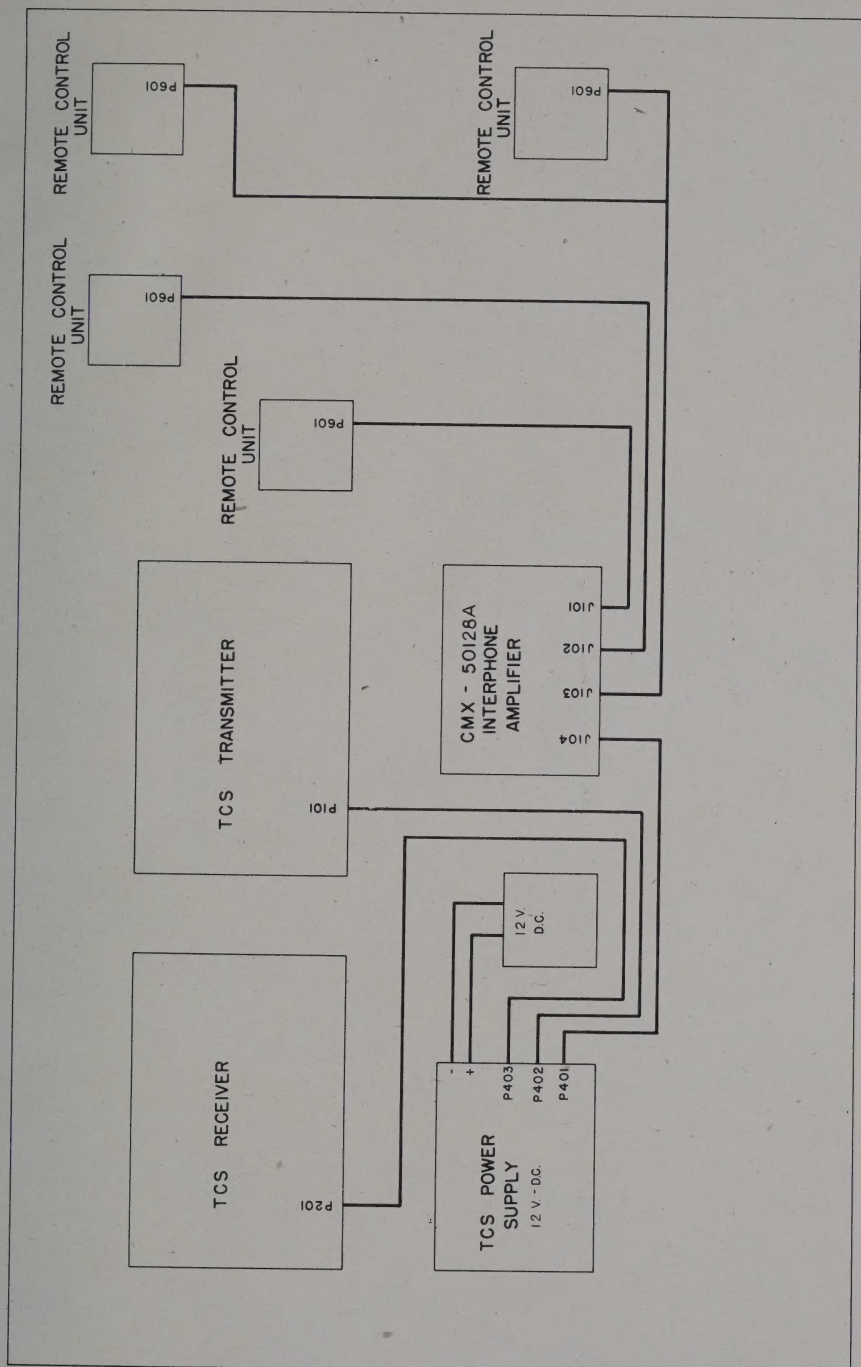


Figure 8 — Typical Installation of Interphone Amplifier

